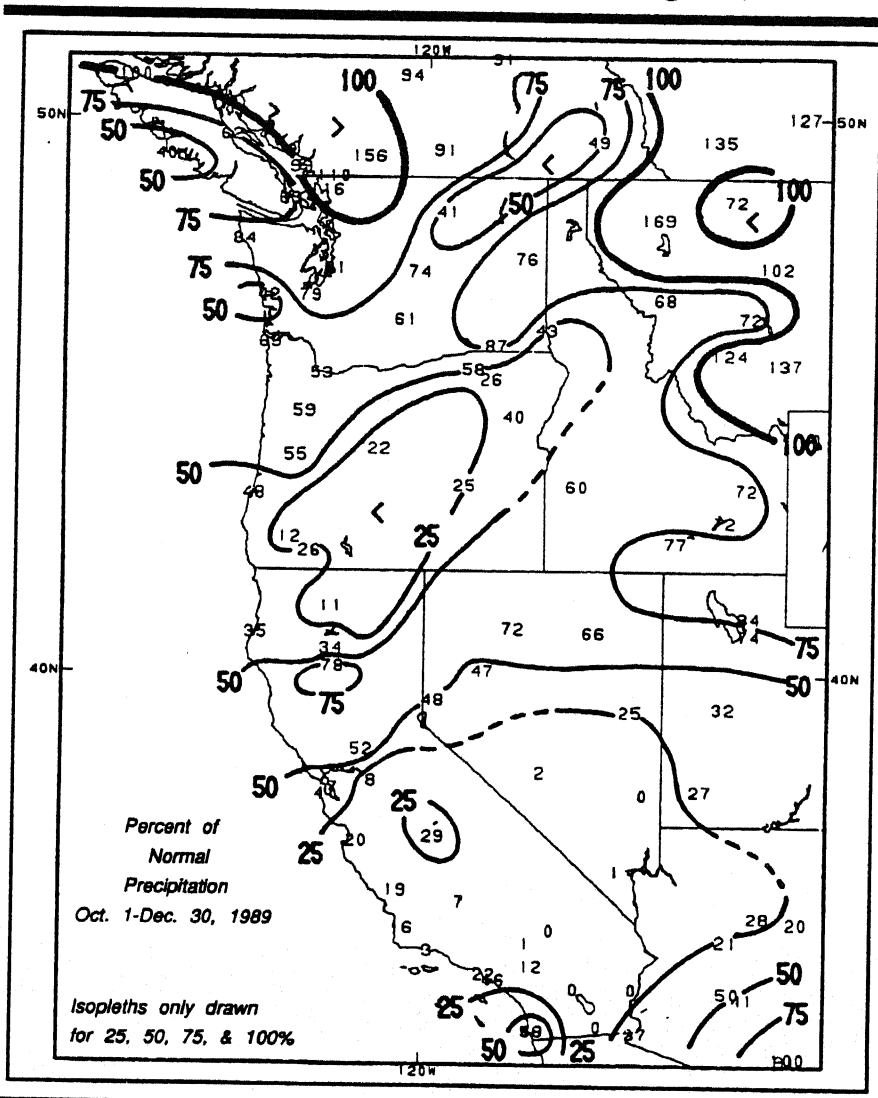
CLIMATE ANALYSIS CENTER

CONTAINS:
SPECIAL ON DRYNESS IN THE FAR WEST

WEEKLY CLIMATE BULLETIN

No. 89/52 **Washington, DC** **December 30, 1989**



A LACK OF SIGNIFICANT DECEMBER PRECIPITATION ALONG THE WEST COAST HAS RAISED CONCERNS FOR THE FOURTH CONSECUTIVE SUBNORMAL RAINY SEASON (APPROXIMATELY OCTOBER–APRIL) IN THE FAR WEST. TO DATE, MANY LOCATIONS HAVE MEASURED LESS THAN HALF THE NORMAL PRECIPITATION SINCE OCTOBER 1, AND MOISTURE RESERVES ARE WELL BELOW NORMAL. FOR ADDITIONAL INFORMATION, REFER TO THE SPECIAL CLIMATE SUMMARY ON PAGES 9–12.

UNITED STATES DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE – NATIONAL METEOROLOGICAL CENTER
CLIMATE ANALYSIS CENTER

WEEKLY CLIMATE BULLETIN

This Bulletin is issued weekly by the Climate Analysis Center and is designed to indicate, in a brief concise format, current surface climatic conditions in the United States and around the world. The Bulletin contains:

- Highlights of major climatic events and anomalies.
- U.S. climatic conditions for the previous week.
- U.S. apparent temperatures (summer) or wind chill (winter).
- U.S. cooling degree days (summer) or heating degree days (winter).
- Global two-week temperature anomalies.
- Global four-week precipitation anomalies.
- Global monthly temperature and precipitation anomalies.
- Global three-month precipitation anomalies (once a month).
- Global twelve-month precipitation anomalies (every three months).
- Global three-month temperature anomalies for winter and summer seasons.
- Special climate summaries, explanations, etc. (as appropriate).

Most analyses contained in this Bulletin are based on preliminary, unchecked data received at the Climate Analysis Center via the Global Telecommunications System. Similar analyses based on final, checked data are likely to differ to some extent from those presented here.

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GLOBAL CLIMATE HIGHLIGHTS

MAJOR EVENTS AND ANOMALIES AS OF DECEMBER 30, 1989

1. *Western United States*:

AREA DOMINATED BY RECORD DRYNESS.

With one day of the month still remaining, San Francisco and Sacramento, CA had yet to receive any measurable December precipitation. If the pattern persists, this will be the driest December at these two stations since 1876 when no rain also fell. A record dry December is also likely at Pocatello, ID where 1.8 mm has been measured thus far. The minimum amount for the month was observed in 1912 and again in 1976 when accumulations equaled 5.1 mm (see Special Climate Summary) [5 weeks].

2. *Eastern Canada and United States*:

TEMPERATURES MODERATE SLIGHTLY.

Minimum temperature departures increased to nearly –10°C, up more than 9°C from the previous week. By late in the week, much above normal temperatures pushed into the central Great Plains and Southeast; however, the mid–Atlantic and New England remained unusually cold as daily temperatures averaged nearly 16°C below normal [9 weeks].

3. *Central Great Plains and Western Corn Belt*:

LIGHT TO MODERATE PRECIPITATION CONTINUES.

Totals varied from 5 to 15 mm over, Missouri, Illinois, and eastern Oklahoma with 25 to 50 mm reported in southern and eastern Arkansas. While scattered pockets of dryness remain in Missouri, the precipitation of the past two weeks has significantly diminished short–term moisture shortages in the state. Meanwhile, dry weather continued throughout much of Kansas and western Oklahoma [15 weeks].

4. *Eastern Brazil*:

ABUNDANT RAINFALL LINGERS.

Flooding conditions persisted in northeastern Brazil as heavy rains pounded the region with nearly 186 mm during the week. Totals for the past four weeks are as much as 670 mm, nearly five times the normal amount [5 weeks].

5. *Southern Europe and European U.S.S.R.*:

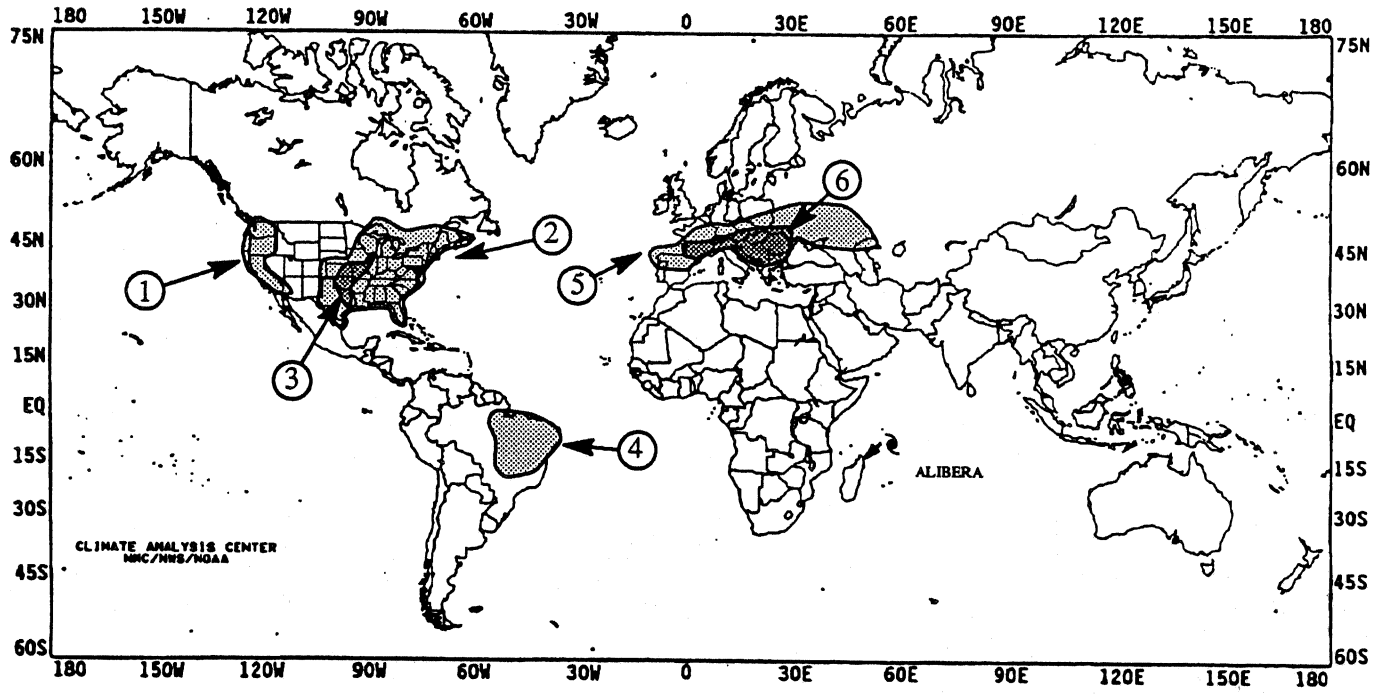
WARMTH EXTENDS INTO SOUTHERN EUROPEAN U.S.S.R.

While temperatures returned to more normal levels across most of southern Europe, temperatures increased in the European U.S.S.R. as departures approached +8°C. Spain and southwestern France remained unusually warm for the 12th straight week with readings as much as 6°C above normal [3 weeks].

6. *Southern Europe*:

REGION TURNS DRY.

Less than half of normal precipitation was observed across a large swath of southern Europe during the past four weeks. The dryness is most pronounced in Hungary, Bulgaria, and Romania where less than 10 mm fell [5 weeks].



EXPLANATION

TEXT: Approximate duration of anomalies is in brackets. Precipitation amounts and temperature departures are this week's values.

MAP: Approximate locations of major anomalies and episodic events are shown. See other maps in this Bulletin for current two week temperature anomalies, four week precipitation anomalies, long–term anomalies, and other details.

UNITED STATES WEEKLY CLIMATE HIGHLIGHTS

FOR THE WEEK OF DECEMBER 24 THROUGH DECEMBER 30, 1989

The week began with some of the decade's coldest air entrenched across the eastern half of the nation. Freezing temperatures were felt as far south as Miami, FL while teens were observed along the Gulf Coast Sunday morning. To make matters worse, a storm system developed along the fringes of the cold air off the southeast Atlantic Coast Saturday night, dropping snow across coastal sections of the Carolinas, Georgia, and in northern portions of Florida Saturday through Sunday morning. Up to 15 inches of snow buried coastal sections of the Carolinas, and the 3 inches that fell on Savannah, GA, the 1 inch that blanketed Jacksonville, FL and the trace observed at Sarasota, FL established new December snowfall records. Wilmington, NC and Myrtle Beach, SC reported blizzard conditions that put 15 inches of snow on the ground and set all–time records for single storm snowfall totals at those locations. Many stations along the southern Atlantic Coast enjoyed their first white Christmas ever.

Fortunately, as the week progressed, the extreme cold spell that had been plaguing the central and eastern U.S. during December finally began to release its grip. Much warmer air filtered into the High Plains on Christmas Eve and eventually displaced the polar air across the Midwest and East. By the end of the week, near to above normal temperatures established themselves across most of the nation.

Precipitation was more plentiful across the contiguous 48 states than in recent weeks, but Hawaii remained unusually dry while the heaviest rainfall once again inundated the southern tier of Alaska. Early in the week, a nasty round of lake–effect snows blasted the snow belt regions of the Great Lakes and Appalachians. Isolated locations in upstate New York reported up to four feet of new snow while many areas across the western Appalachians and upper Michigan reported more than a foot.

Farther west, a series of weak frontal systems headed for southwestern Canada brought several periods of light rain to the Pacific Northwest during the last half of the week. Late in the week, an upper–level disturbance brought light rain and snow to the southern halves of the Rockies and High Plains before the system tapped moisture from the Gulf of Mexico and began to intensify. Moderate to heavy rainfall then developed across the lower Mississippi Valley, with lesser amounts falling to the north

aforementioned system pulled in warm
e eastern third of the nation, but cold air
surface. This allowed a mixture of sleet,
to develop across much of the Midwest,
rtheast early Saturday. Although amounts
l problems developed as roads quickly iced
ation began. Most precipitation quickly
and ended on Saturday, but portions of
w York observed subfreezing temperatures
a second batch of precipitation approached.
t, rain was accompanied by dense fog across
central Appalachians late Saturday as the
d moist Gulf air mixed with the shallow but
d. Visibilities well below half a mile made
ven in those areas spared any prolonged freezing or frozen precipitation.

According to the River Forecast Centers, most of the heavy precipitation in the lower 48 states fell in conjunction with the late storm that traversed the southern tier of states (see Table 1). Up to 6.4 inches of rain drenched parts of the lower Mississippi Valley and northern Gulf Coast while reports of 2 to 4 inches were common in the Tennessee Valley and norther portions of Mississippi and Alabama.

Generally one to two inches fell across the southeastern half of the Midwest, the central and southern Appalachians, and central Arizona. In the latter area, this marks the heaviest precipitation to affect the parched region since the remnants of Hurricane Raymond moved northward from the Gulf of Baja in early October. Light precipitation was reported in the central Rockies, Great Lakes, and Northeast while little or no rain or snow fell elsewhere. The lack of precipitation is beginning to generate serious concern in the Far West as several stations in California established new minimum precipitation records for December while snowpack in the Cascades is running below one–third of normal (refer to this week's Special Climate Summary for more details).

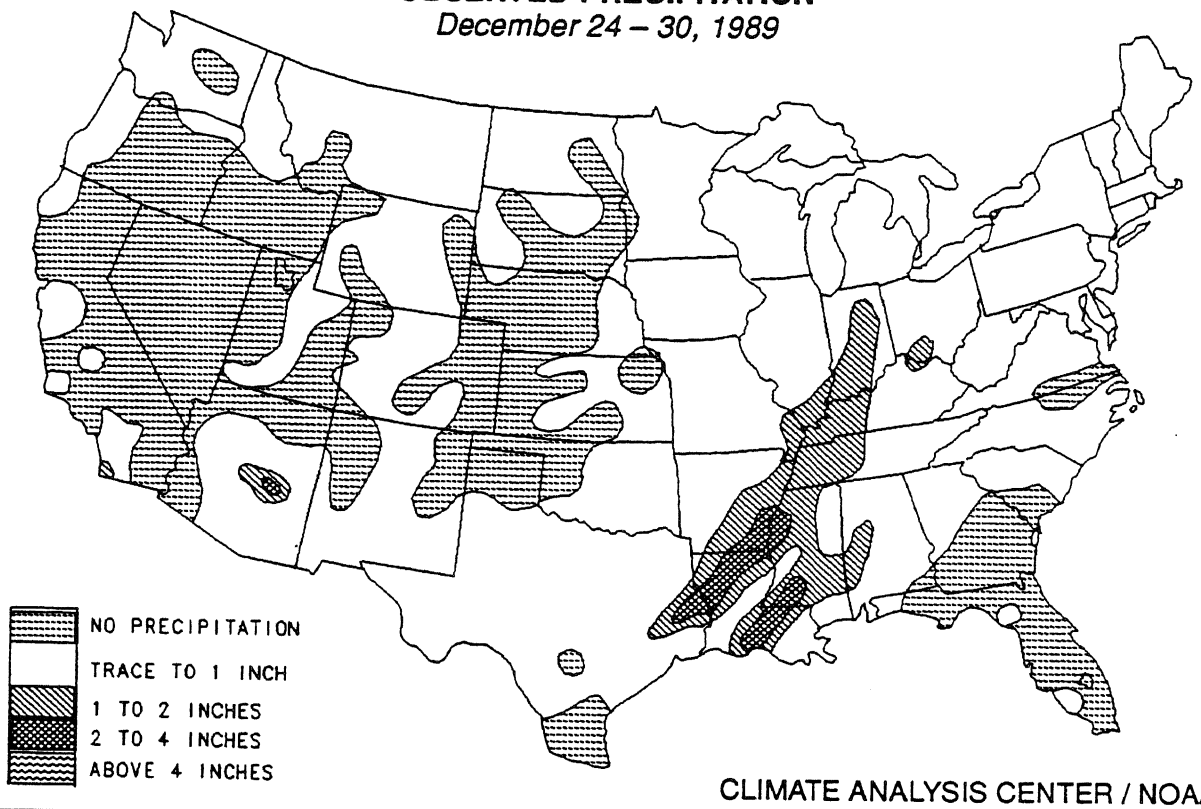
In contrast, southern Alaska experienced copious precipitation for the third consecutive week. Up to 10 inches of precipitation drenched southeastern Alaska while large amounts of rain and snow were also reported across the south–central and Aleutian regions. The precipitation is welcome in southeastern Alaska, where large deficits accumulated from exceedingly dry weather that plagued the region during the first half of the year.

The central U.S. finally freed itself from the icy Arctic grip that has held the region during most of December, but unusually cold air was slow to depart the East Coast. Even as the week began with all–time record cold observed in Wilmington, NC (0°F) and Miami, FL (30°F), warm weather developed across the High Plains. By the weekend, the frigid air had departed the Deep South, but was slow to leave the immediate Eastern Seaboard and Northeast. As a result, temperatures averaged 12°F to 18°F below normal throughout the Florida Peninsula, along the south Atlantic Coast, and across the northeastern quarter of the nation (see Table 3). Hundreds of record daily minimums were established on Sunday and Monday, along with more than a dozen record December lows.

In addition, well below normal temperatures were also observed across much of the central Intermountain West and Far West, where temperatures averaged up to 8°F below normal and several daily minimum temperature records were broken. Downsloping winds, however, generated warm weather in southern California and portions of the northern and central High Plains where temperatures averaged up to 8°F above normal. Near normal temperatures were observed across the rest of the contiguous 48 states as well as in Hawaii, but much of Alaska remained unseasonably warm (see Table 2). Temperatures averaged up to 28°F above normal in southern portions of the state, but much colder weather invaded the northern third, where several stations observed temperatures 10°F to 13°F below normal.

OBSERVED PRECIPITATION

December 24 – 30, 1989



CLIMATE ANALYSIS CENTER / NOAA

DEPARTURE OF AVERAGE TEMPERATURE FROM NORMAL (°F)

December 24 – 30, 1989

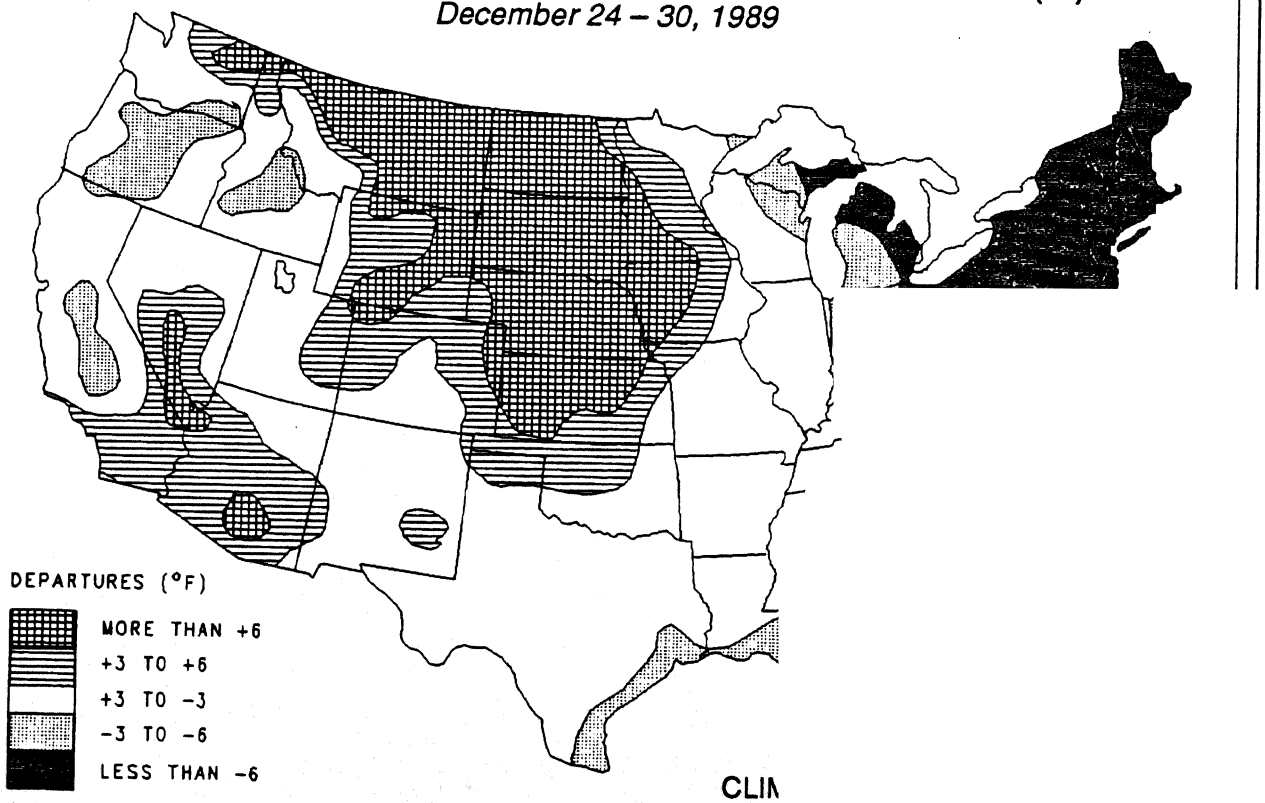


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TABLE 1. Selected stations with 2.00 or more inches of precipitation for the week.

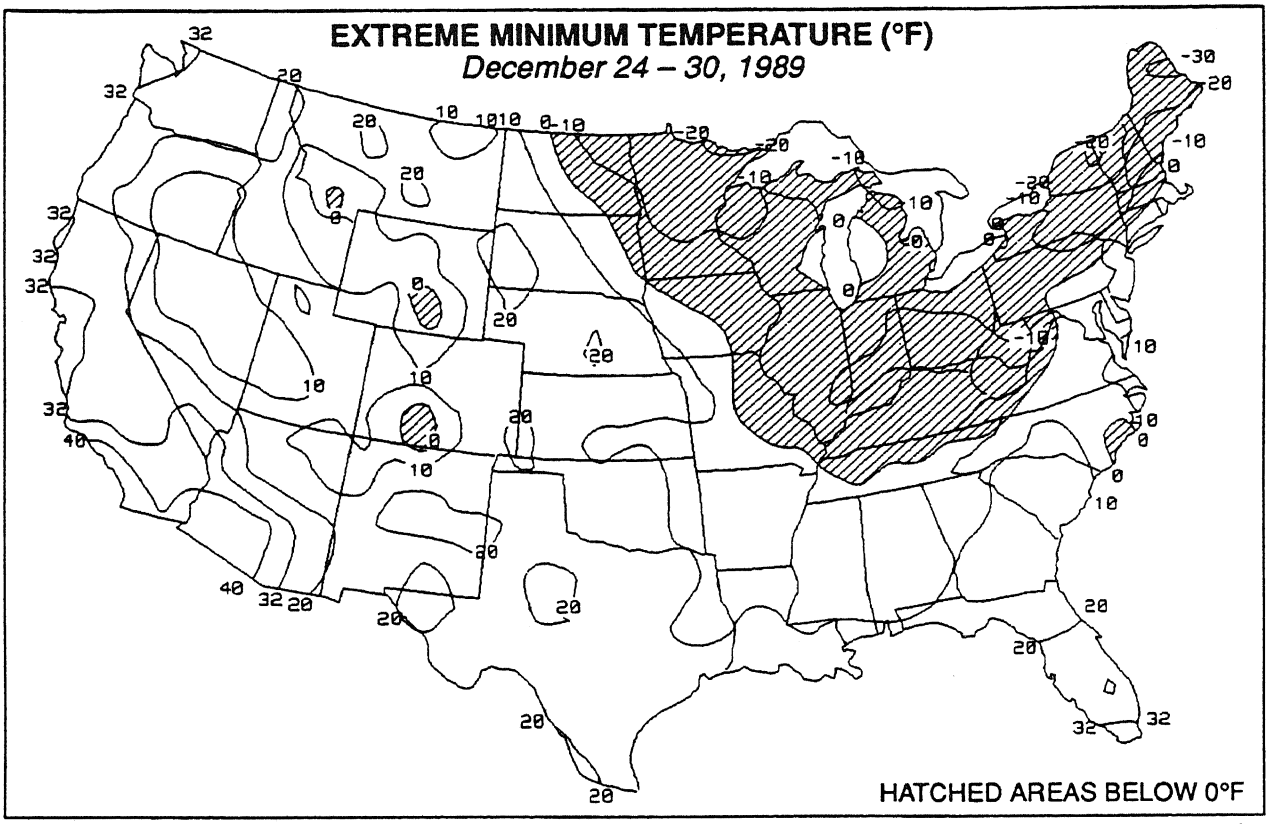
STATION	TOTAL (INCHES)	STATION	TOTAL (INCHES)
YAKUTAT, AK	10.04	LAFAYETTE, LA	3.26
CORDOVA/MILE 13, AK	7.35	SITKA, AK	3.04
ANNETTE ISLAND, AK	5.71	BOSSIER CITY/BARKSDALE AFB, LA	2.72
KETCHIKAN, AK	5.66	MONROE, LA	2.64
VALDEZ, AK	4.98	KODIAK, AK	2.12

TABLE 2. Selected stations with temperatures averaging 10.0°F or more ABOVE normal for the week.

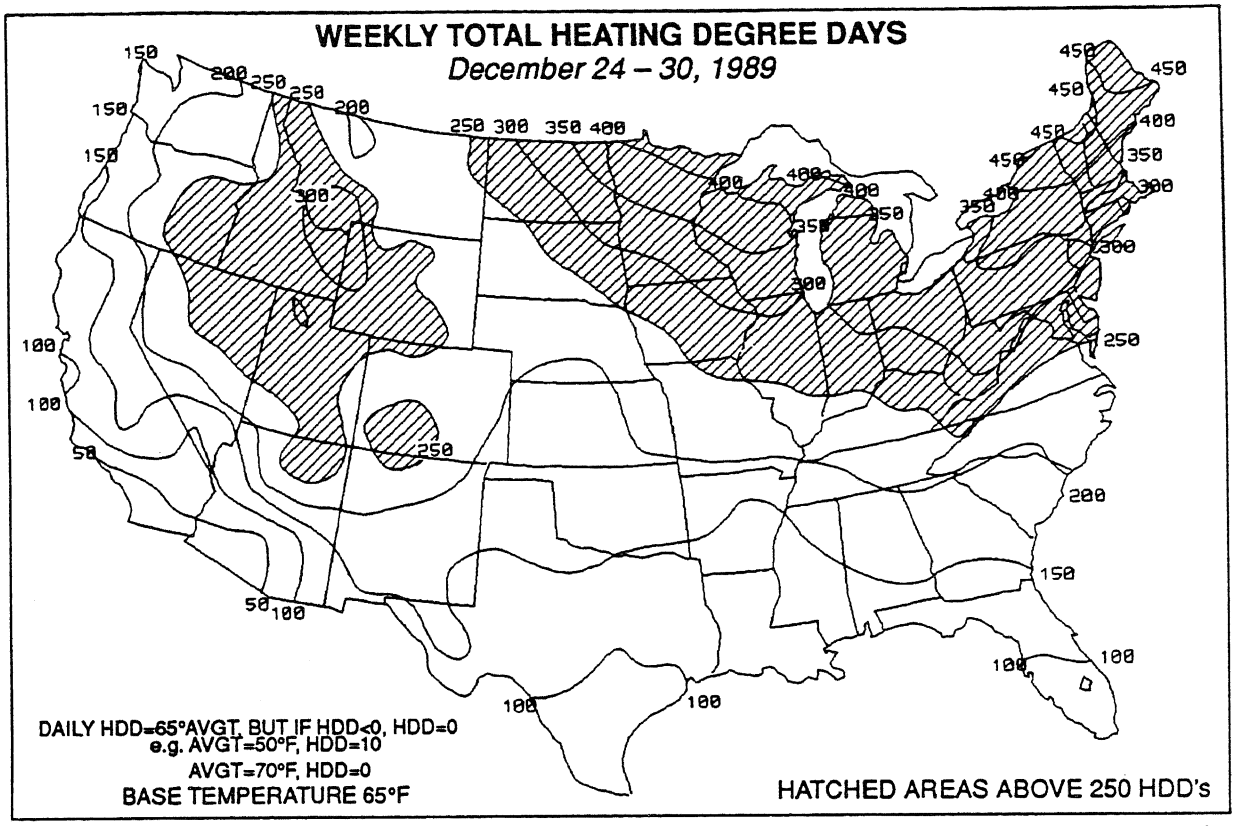
STATION	DEPARTURE (°F)	AVERAGE (°F)	STATION	DEPARTURE (°F)	AVERAGE (°F)
GULKANA, AK	+28.2	19.6	RAPID CITY, SD	+11.8	35.5
NORTHWAY, AK	+19.7	-0.9	FAIRBANKS, AK	+11.8	-0.8
CUT BANK, MT	+18.4	36.6	VALENTINE, NE	+11.6	33.1
JUNEAU, AK	+16.2	41.0	HURON, SD	+11.5	26.7
WILLISTON, ND	+15.6	27.1	NORTH PLATTE, NE	+11.1	34.7
GREAT FALLS, MT	+14.9	38.2	NORFOLK, NE	+11.0	31.6
GLASGOW, MT	+14.5	27.4	PIERRE, SD	+10.9	29.3
HAVRE, MT	+13.7	29.6	CORDOVA/MILE 13, AK	+10.7	32.6
YAKUTAT, AK	+13.4	38.6	JAMESTOWN, ND	+10.7	20.1
GRAND ISLAND, NE	+13.0	36.7	BIG DELTA, AK	+10.7	4.0
DICKINSON, ND	+12.8	27.9	SIOUX FALLS, SD	+10.5	26.6
VALDEZ, AK	+12.7	30.5	ANNETTE ISLAND, AK	+10.4	44.7
BISMARCK, ND	+12.7	24.0	ABERDEEN, SD	+10.3	22.4
MILES CITY, MT	+12.2	30.4	OMAK, WA	+10.0	34.7
MINOT, ND	+12.2	22.8	LINCOLN, NE	+10.0	33.0
SITKA, AK	+11.8	42.9	LEWISTOWN, MT	+10.0	31.6

: 3. Selected stations with temperatures averaging 11.0°F or more BELOW normal for the week.

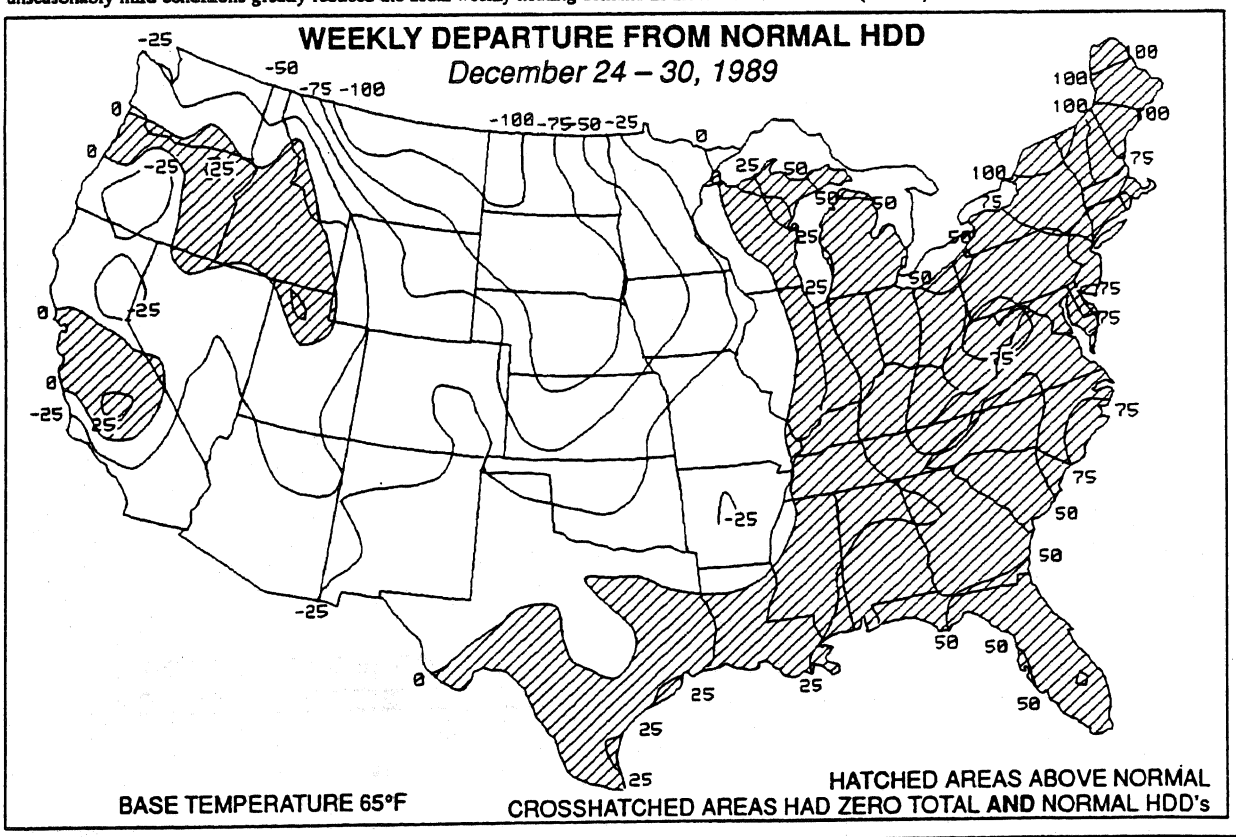
	DEPARTURE (°F)	AVERAGE (°F)	STATION	DEPARTURE (°F)	AVERAGE (°F)
[illegible]	-17.9	-4.2	PARKERSBURG, WV	-12.4	20.8
MASSENA, NY	-17.5	-1.2	MIAMI, FL	-12.4	55.1
ELKINS, WV	-16.4	14.6	CONCORD, NH	-12.3	9.3
BURLINGTON, VT	-15.9	3.2	VERO BEACH, FL	-12.3	49.8
BANGOR, ME	-15.7	3.9	MELBOURNE, FL	-12.2	49.7
GLENS FALLS, NY	-15.6	5.1	UTICA, NY	-12.0	10.2
AUGUSTA, ME	-15.3	5.5	ATLANTIC CITY, NJ	-12.0	22.0
MONTPELIER, VT	-14.8	2.5	WORCESTER, MA	-11.9	12.6
CARIBOU, ME	-13.7	-1.5	WRIGHTSTOWN/MCGUIRE AFB, NJ	-11.9	21.7
POUGHKEEPSIE, NY	-13.7	12.6	ROME/GRIFFISS AFB, NY	-11.8	10.9
NEW BERN, NC	-13.5	31.3	MILLVILLE, NJ	-11.8	21.6
GAINESVILLE, FL	-13.4	43.8	MT. WASHINGTON, NH	-11.7	-5.1
WEST PALM BEACH, FL	-13.2	52.8	DOVER AFB, DE	-11.6	23.8
RUMFORD, ME	-13.0	5.0	WILKES-BARRE, PA	-11.5	15.8
WILMINGTON, NC	-12.9	33.6	WASHINGTON/DULLES, VA	-11.5	21.4
BOSTON/LOGAN, MA	-12.6	18.1	HARTFORD, CT	-11.3	15.3
PORTLAND, ME	-12.5	10.3	PROVIDENCE, RI	-11.2	18.7
ALBANY, NY	-12.5	10.8	MORGANTOWN, WV	-11.1	20.6
SYRACUSE, NY	-12.5	12.9	SALISBURY, MD	-11.1	25.5



Bitterly cold Arctic air covered the eastern third of the country early in the week, but temperatures gradually moderated across the region by week's end. Before the warming trend , however, lows plunged well below 0°F in the Midwest and New England and single digit readings were recorded as far south as the Gulf Coast (top). Strong winds also accompanied the low temperatures as dangerous wind chills (less than –20°F) occurred throughout the Midwest and the Northeast early in the week (bottom).

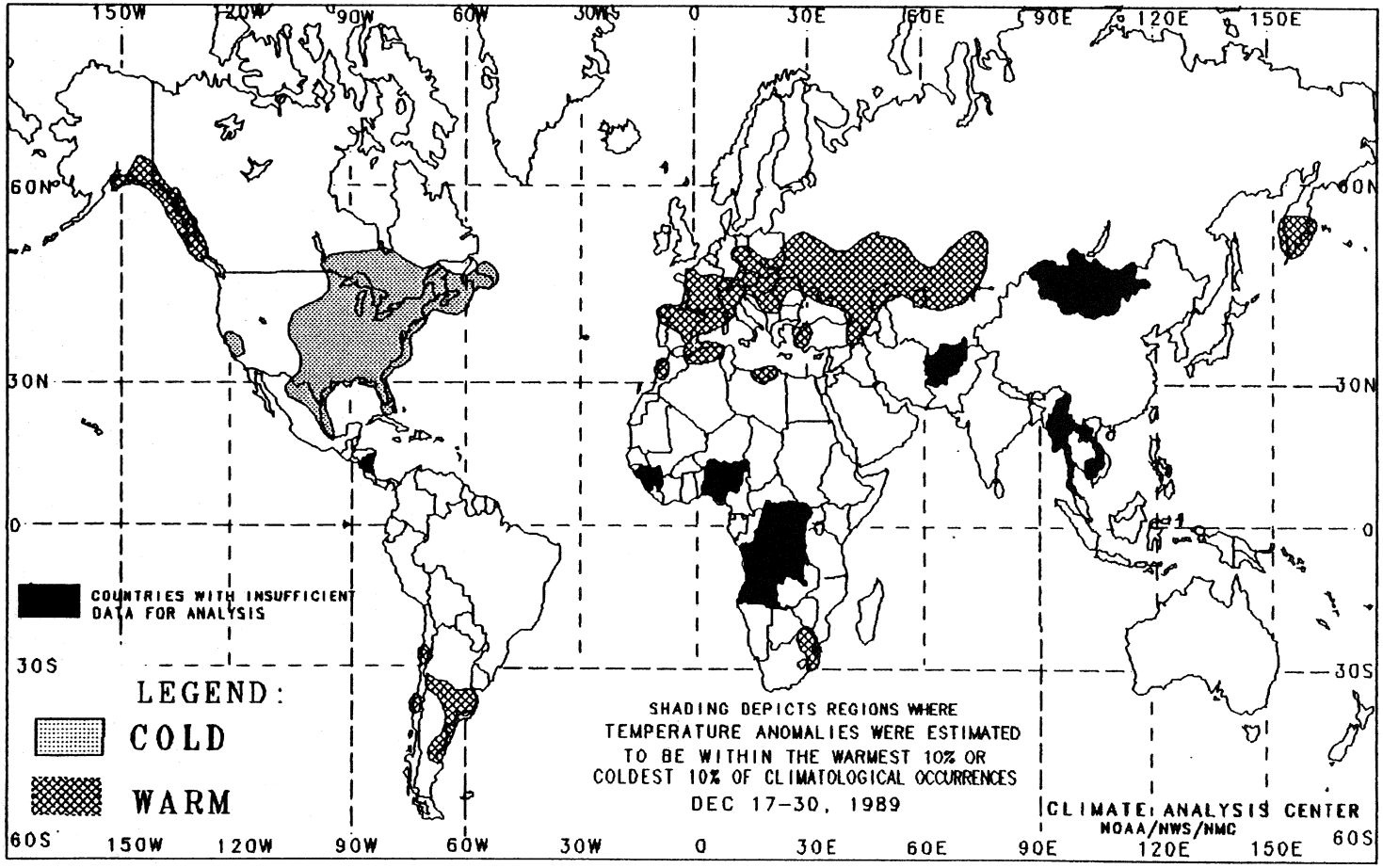


Milder weather finally replaced the excessively cold conditions in the nation's midsection, but subnormal temperatures and above normal weekly heating demand persisted along the East Coast and Great Lakes. The largest heating usage (more than 300 HDD's) occurred in the upper Midwest, Great Lakes, and New England (top) while portions of the Northeast and mid-Atlantic observed weekly heating departures in excess of +75 HDD's. In contrast, unseasonably mild conditions greatly reduced the usual weekly heating demand in the north-central U. S. (bottom).



GLOBAL TEMPERATURE ANOMALIES

2 WEEKS



pproximately 2500 observing stations
vations were received from synoptic
enty-four hour basis so many night
of these missing observations the
warm bias. This in turn may have
some warm anomalies.

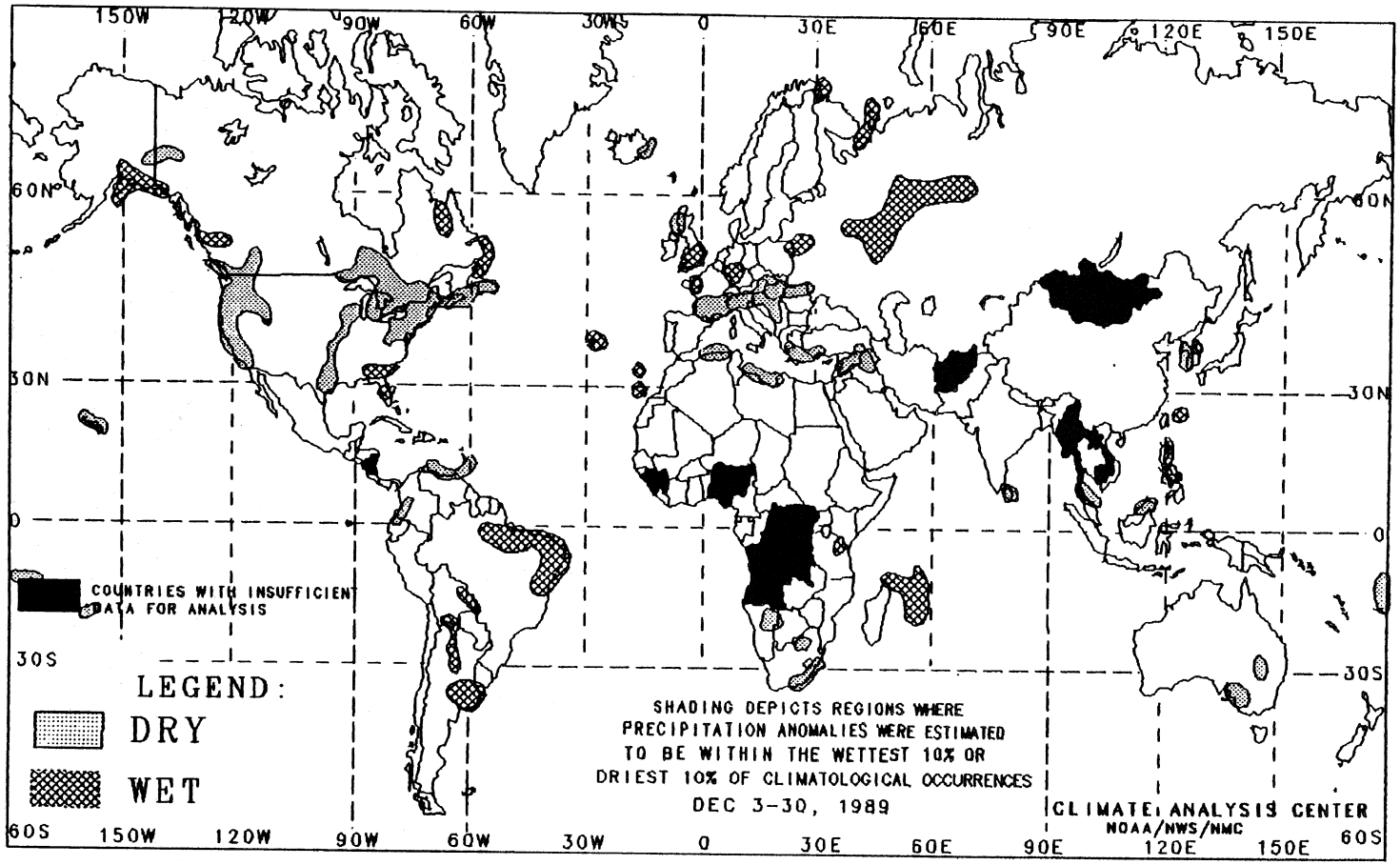
nless the magnitude of temperature

In some regions, insufficient data exist to determine the magnitude of anomalies. These regions are located in parts of tropical Africa, southwestern Asia, interior equatorial South America, and along the Arctic Coast. Either current data are too sparse or incomplete for analysis, or historical data are insufficient for determining percentiles, or both. No attempt has been made to estimate the magnitude of anomalies in such regions.

This chart shows general areas of two week temperature anomalies. Caution must be used in relating it to local conditions, especially in mountainous regions.

GLOBAL PRECIPITATION ANOMALIES

4 WEEKS



The anomalies on this chart are based on approximately 2500 observing stations for which at least 27 days of precipitation observations (including zero amounts) were received or estimated from synoptic reports. As a result of both missing observations and the use of estimates from synoptic reports (which are conservative), a dry bias in the total precipitation amount may exist for some stations used in this analysis. This in turn may have resulted in an overestimation of the extent of some dry anomalies.

In climatologically arid regions where normal precipitation for the four week period is less than 20 mm, dry anomalies are not depicted. Additionally, wet anomalies for such arid regions are not depicted unless the total four week precipitation exceeds 50 mm.

In some regions, insufficient data exist to determine the magnitude of anomalies. These regions are located in parts of tropical Africa, southwestern Asia, interior equatorial South America, and along the Arctic Coast. Either current data are too sparse or incomplete for analysis, or historical data are insufficient for determining percentiles, or both. No attempt has been made to estimate the magnitude of anomalies in such regions.

The chart shows general areas of four week precipitation anomalies. Caution must be used in relating it to local conditions, especially in mountainous regions.

SPECIAL CLIMATE SUMMARY

CLIMATE ANALYSIS CENTER,NMC
NATIONAL WEATHER SERVICE, NOAA

EXTREMELY DRY WEATHER THE PAST TWO MONTHS HAVE RAISED CONCERNS OF ANOTHER SUBNORMAL RAINY SEASON IN THE FAR WEST

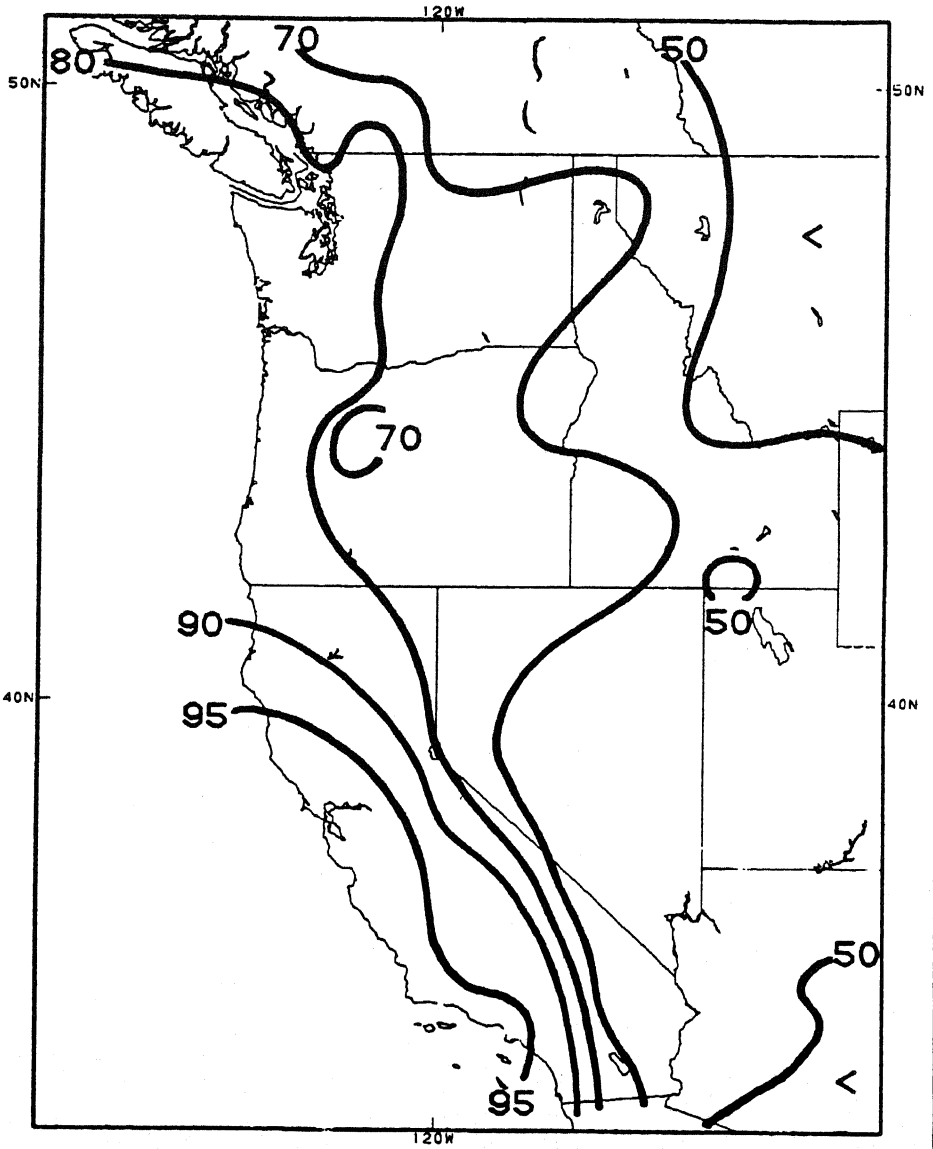


Figure 1. Percent of the normal annual precipitation received during the seven-month period of October-April. Isopleths are only analyzed for 50, 70, 80, 90, and 95%. The Pacific Coast usually receives over 80% of its yearly precipitation during the late fall, winter, and early spring months, and western sections of California observes nearly all of their January-December precipitation during this 7-month period. The three wettest months of the year (December-February) normally supply between 45% and 65% of the annual precipitation along the West Coast (figure not shown).

The vast majority of the annual precipitation in the Far West normally occurs during the winter months of December–February, although significant precipitation may also fall during the transitional months of autumn (October and November) and spring (March and April). Between 45% and 65% of the January–December precipitation is usually received during the three winter months along the West Coast, while more than 80% of the yearly precipitation normally falls during October–April along the Pacific Coast and in the Cascades and Sierra Nevada Mountains (see Figure 1).

By the late spring and continuing into the early fall, most of these areas usually record little or no precipitation. As a result, most locales heavily depend upon adequate winter precipitation to replenish reservoirs and the mountain snowpack, which in turn supply irrigation, drinking water, and hydroelectrical power.

A long–term October–March precipitation index for the western U.S. and extreme southwestern Canada (regions bounded by Figures 3–4, between 32°N–51°N and 110°W–129°W) since 1881 is depicted by Figure 2. The numerical values are arbitrary and intended only for comparison purposes. The zero line represents the mean value for the period of record, and positive (negative) values represent above (below) normal areally–averaged total precipitation. The year refers to the first month of the six–month period (e.g. 1981 represents October 1981–March 1982). The number of stations with complete historical data during each six–month period varies, ranging from 11 (in 1883–84) up to 50 (many different years).

Based upon the index, subnormal precipitation has now afflicted the Far West, especially California, the past three seasons, and were it not for torrential precipitation during February 1986, the past 5 years would have been drier than normal. For a review of the last three winter seasons in the Far West, refer to the Weekly Climate Bulletins #87/18, #88/16 and 20, and #89/17.

Since October 1, 1989, most of the Far West has observed less than half the normal precipitation, while much of southern California and Nevada have recorded well under 25% of normal (see front cover). Only parts of the northern Cascades and Rockies have reported surplus precipitation. A persistent ridge of high pressure anchored over the West Coast has veered most Pacific storm systems northward into western Canada and kept much of the Far West dry.

Precipitation totals during the past 13 weeks have ranged from under an inch in the normally drier southern sections to more than 30 inches in the normally wetter northern Cascades and along the Washington coast (see Figure 3). The greatest accumulated deficits (more than 8 inches) were found along the Pacific Northwest Coast and on Vancouver Island (see Figure 4). Furthermore, much of the precipitation that has fallen since Oct. 1 occurred early in the season, particularly during late October and mid–November, and the past several weeks have been exceptionally dry throughout the Far West.

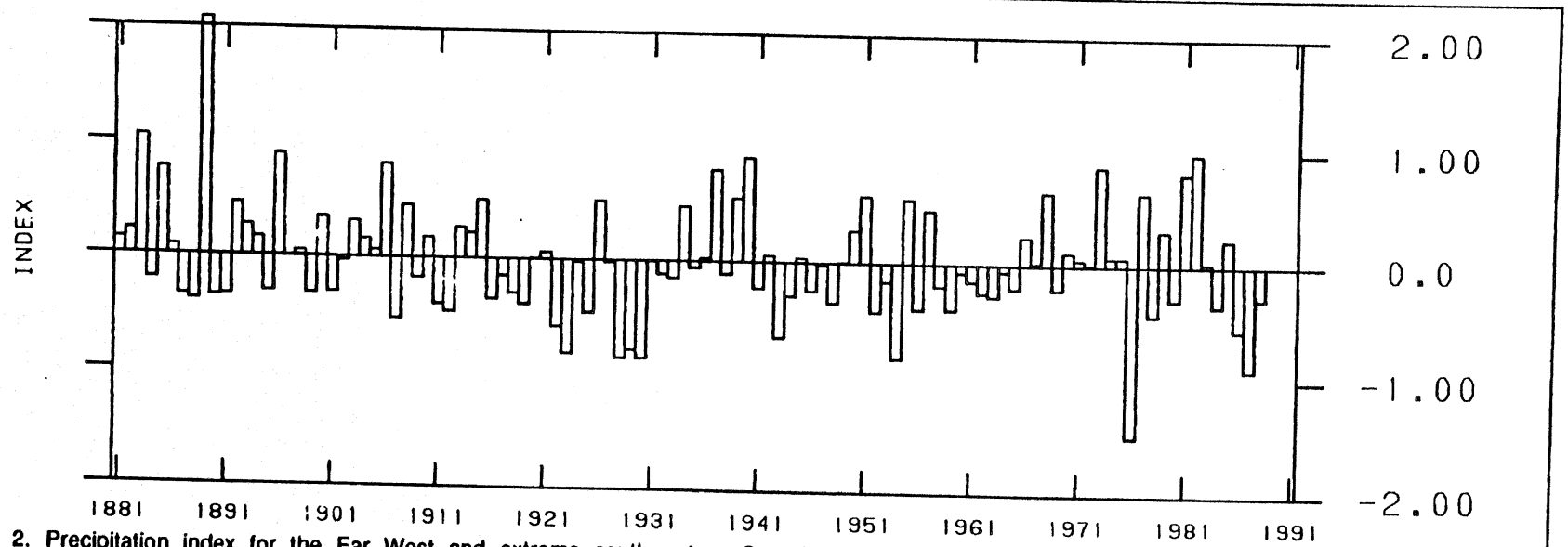


Figure 2. Precipitation index for the Far West and extreme southwestern Canada (as depicted in Figures 1, 3, and 4; between 32°N-51°N and 110°W-129°W) for the six-month period of October-March since 1881. The numerical values are arbitrary and are intended only for comparison purposes. The zero line represents the mean value for the period of record. The year refers to the first of the six-month period (e.g. 1981 represents Oct. 1981-March 1982). The number of stations with complete historical data for each six-month period varied, ranging from a minimum of 11 (in 1883-84) up to a maximum of 50 (many different years). Based upon the index, the October-March precipitation has been below normal during the last three and in four of the past five years in the Far West, especially in California.

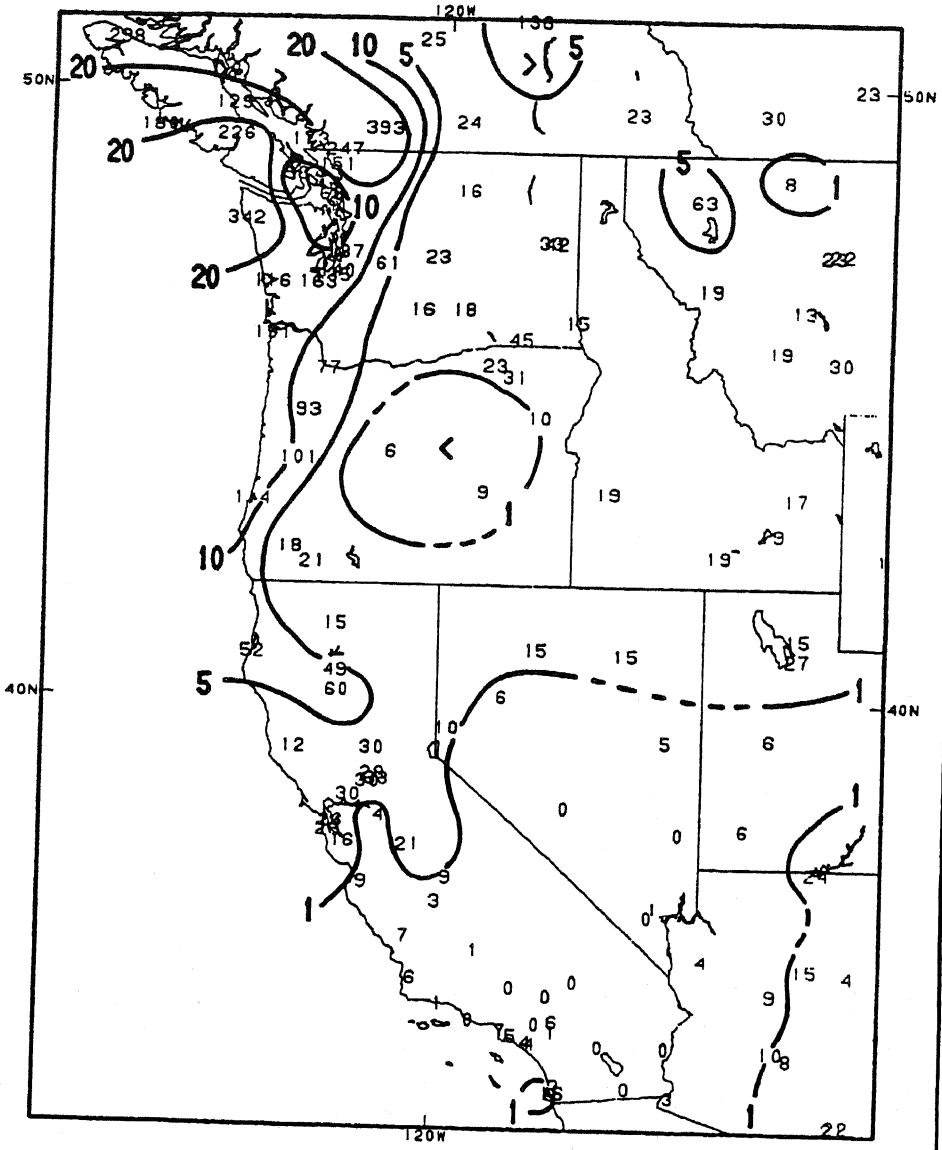


Figure 3. Total precipitation (inches) during October 1-December 30, 1989 (91 days). A station required 90% (81 days) or more of the days for inclusion. Isohyets are only drawn for 1, 5, 10, and 20 inches, and plotted station values are in tenths of inches (e.g. 15=1.5 inches). Very little precipitation has fallen on the southern portions of the Far West since October 1, and totals along the usually wet Pacific Northwest Coast and in the Sierra Nevada and Cascade Mountains are also well below normal.

On a state by state basis, the percent of normal precipitation and snowpack data during Oct. 1, 1989–Jan. 1, 1990 from the 560 station Soil Conservation Service network are summarized in Table 1. In addition to this information, the Western Regional Climate Center has also supplied the percent of normal precipitation and snowpack for several major river basins for the same time period in Table 2. Through Jan. 1, almost every western state and major river basin, with a few exceptions, were well below the long–term averages.

On a local basis, the snowpack at Mt. Hood, OR on Jan. 1 had 9.4 inches of water–equivalence (normally 27.6 inches), while the snowpack at Mt. Olallie, WA in the northern Cascades had only 5.7 inches of water–equivalence (normally 29.2 inches) even though the station had measured 96% of its normal precipitation since Oct. 1. Unfortunately, much of its precipitation had fallen as rain and not in the more desirable form of slowly melting snow. Many ski resorts, with the lack of natural snow, have been forced to make their own. This has not only caused delays in openings, but has also forced the resorts to operate at partial capacity.

As a result of the current conditions, there are concerns about a fourth consecutive subnormal rainy season in the Far West which would have detrimental impacts later in the year. With nearly half of the 1989–1990 rainy season gone, it appears that the West must depend upon timely and plentiful January–April precipitation to assure itself of sufficient moisture reserves during the upcoming dry summer and early autumn seasons.

Table 1. State–by–state averages of the percentages from normal precipitation and mountain snowpack during Oct. 1, 1989 – Jan. 1, 1990.

State	Percent of Normal Snowpack	Precipitation
Arizona	25	34
California (Great Basin area only)	39	45
Colorado	56	65
Idaho	43	65
Montana	82	114
Nevada	43	48
New Mexico	26	60
Oregon	25	50
Utah	44	51
Washington	34	73
Wyoming	87	102
Region (except rest of California)	51	67

WESTERN REGIONAL CLIMATE CENTER

SOIL CONSERVATION SERVICE

Table 2. Selected major river basin averages of the percentages from normal precipitation and mountain snowpack during Oct. 1, 1989 – Jan. 1, 1990.

River Basin	Percent of Normal Snowpack	Precipitation
Arkansas River	80	80
Colorado River	53	59
Missouri River	97	114
Columbia River	42	65
Rio Grande River	19	53
Great Basin	41	48

Of the 69 river basins:
- 13 had <25% snowpack
- 43 had <50% snowpack
- 54 had <75% snowpack
- 63 had <100% snowpack

only 6 had above normal snowpack.

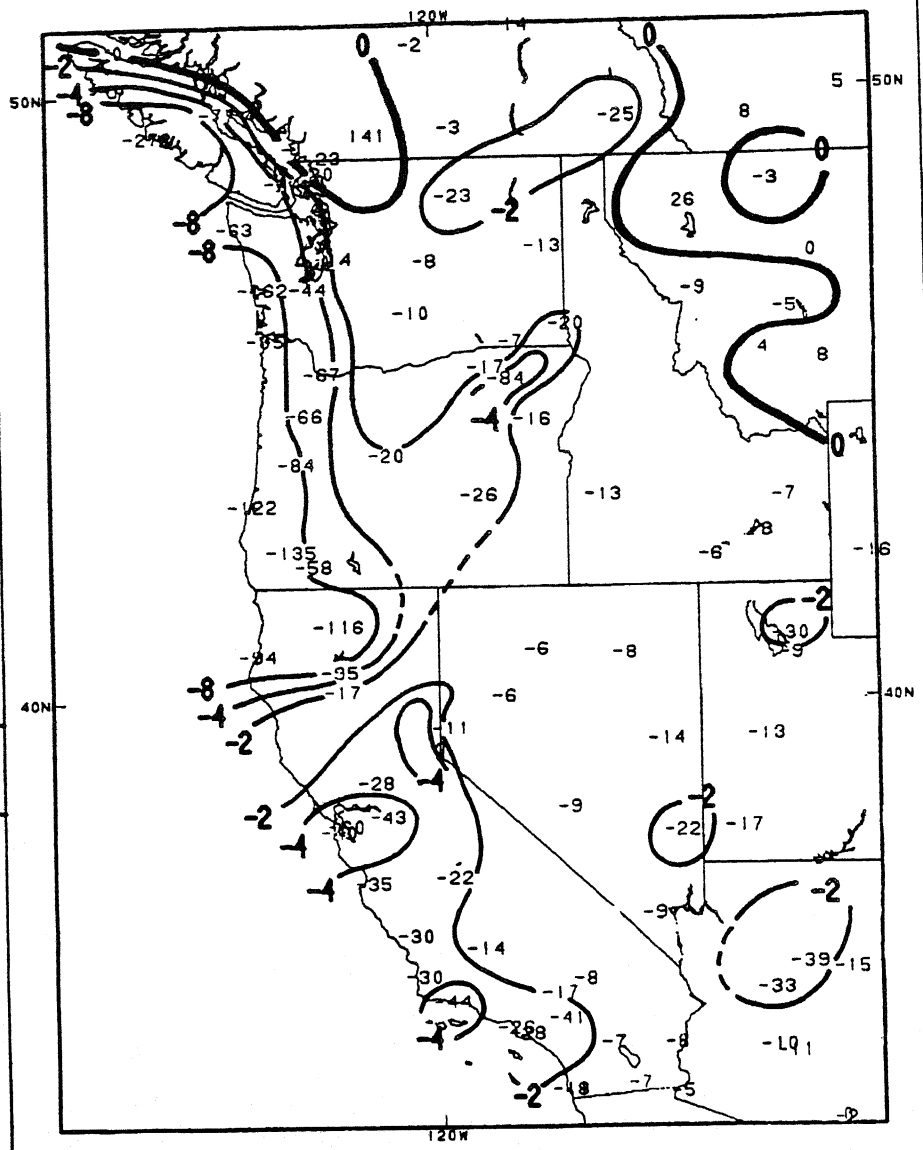


Figure 4. Departure from normal precipitation (inches) during October 1-December 30, 1989 (91 days). A station required 90% (81 days) or more of the days for inclusion. Isopleths are only drawn for 0, -2, -4, and -8 inches, and plotted station values are in tenths of inches (e.g. -135=-13.5 inches). The greatest deficits were located along the normally rainy Pacific Northwest Coast and in Vancouver Island (more than 8 inches), and along coastal California (between 2 and 4 inches) as meager rainfall has occurred at the latter region during the past 13 weeks.